INTERIM REMEDIAL ACTION PLAN
RAMCO ALUMINUM WASTE DISPOSAL SITE
PORT OF KLICKITAT INDUSTRIAL PARK
DALLESPORT, WASHINGTON

October 9, 2006

Prepared by Washington State Department of Ecology
Toxics Cleanup Program
Robert D. Swackhamer PE (509) 454-7840

1.0 INTRODUCTION

1.1 PURPOSE OF THIS DOCUMENT

The purpose of this Interim Remedial Action Plan is to fulfill the requirements of Washington Administrative Code (WAC) 173-340-430, which include a requirement that, except in certain circumstances, a report be prepared before conducting an interim action under the Model Toxics Control Act.

1.2 SUMMARY OF PROPOSED INTERIM ACTION

The Department of Ecology proposes to excavate waste from secondary aluminum smelting deposited at a site in the Port of Klickitat Industrial Park near Dallesport, Washington, and haul the waste by truck or truck and rail transportation to a landfill for disposal.

The excavation would be accomplished by front-end loader, hydraulic excavator, bulldozer, or similar mobile equipment. Some of the excavated material may need to be crushed before being transported to the landfill.

The Roosevelt Regional Landfill is located in eastern Klickitat County approximately 5 miles north of Roosevelt, Washington. The Columbia Ridge Landfill is located near Arlington, Oregon. Both of these landfills are designed to meet the liner and monitoring requirements of RCRA Subtitle D. It is possible that the contracting process could result in transporting the material to one of these landfills or to a more distant landfill.

2.0 SITE DESCRIPTION

2.1 BACKGROUND

Recycled Aluminum Metals Company[1] (RAMCO or RAMCo) occupied a building located within the Port of Klickitat Industrial Park, where it extracted aluminum from dross it received from primary aluminum smelters in the Northwest. Dross is a by-product from the primary smelting process. However, it still contains aluminum in recoverable amounts.

The extraction process used at RAMCO consisted of heating the dross in a gas-fired furnace, and adding salt (sodium chloride) to the furnace as a fluxing agent. This helped separate out the aluminum. At the end of a four-hour run, molten aluminum was tapped out of the furnace into ingots. The molten salt remaining in the furnace then was skimmed out of the furnace either into metal molds or onto a bed of sand on a concrete floor, where it cooled and hardened. The salt cake was then a waste that required management and disposal.

From approximately 1982 to 1989, RAMCO placed this salt cake plus a smaller amount of baghouse dust in an unlined landfill at a location separated from the RAMCO building by about

[1]Recycled Aluminum Metals Company was a subsidiary of Robert A. Barnes, Inc. In some records, particularly prior to 1988, the company is called "R. A. Barnes."

½ mile, near the eastern boundary of the Dallesport Industrial Park. This unlined landfill will be the location of the Interim Remedial Action proposed in this document.

After RAMCO ceased placing material in the unlined landfill in approximately 1989, there was a period when aluminum waste from RAMCO was sent to the North Wasco County Landfill across the Columbia River in Oregon for disposal. In approximately 1991, RAMCO stopped shipping the waste off-site and began stockpiling it on Port of Klickitat property adjacent to the building leased by RAMCO.

RAMCO ceased operations in the Dallesport Industrial Park, and therefore ceased producing waste, in approximately 1993. This left the Port of Klickitat with a large open stockpile of aluminum waste on one part of its property, as well as the aluminum waste that had been buried in the landfill on another part of its property.

Ecology and the Port of Klickitat pursued and obtained funding from the financially struggling RAMCO to deal with the open stockpile of waste. By 1995, the approximately 21,433 tons of waste in the open stockpile had been crushed, aerated through open storage, and then transported to Roosevelt Regional Landfill for disposal. The crushing and aeration, which was a form of "Treatment by Generator" under Dangerous Waste regulations and policy in effect at the time, rendered the material acceptable for disposal at Roosevelt Regional Landfill under a petition filed by RAMCO and granted by the Department of Ecology.

The RAMCO pyrometallurgical equipment was sold to Imsamet Acquisition Corporation and removed from the Dallesport Industrial Park. The aluminum waste that had been buried in the unlined landfill from 1982 to 1989 remains there today.

2.2 SITE INVESTIGATION

The Dallesport Industrial Park, owned and operated by the Port of Klickitat, is located immediately east of Washington State Highway 197 and approximately two miles east of the small community of Dallesport, Washington. Across the Columbia River from the Dallesport Industrial Park is the city of The Dalles, Oregon, with a population of 12,250 in 2002. Spanning the Columbia River since 1957 between Dallesport Industrial Park and the city of The Dalles is The Dalles Dam, operated by the US Army Corps of Engineers.

The unlined landfill, the target of the interim remedial action described here, is located about 400 feet southwest of Spearfish Lake, about 500 feet north of a pond known as Joe's Lake, and about 1000 feet north of Lake Celilo, the name of the portion of the Columbia River that is impounded behind The Dalles Dam. On average, the site receives approximately 14 inches of precipitation per year. Groundwater in the area is approximately 60 to 80 feet below ground surface level.

The landfill covers approximately 1.5 acres and contains an estimated 63,200 cubic yards, with the waste being approximately 30 feet deep at its deepest point. The landfill sits in a small bowl,

underlain and surrounded on almost three sides by Columbia River Basalt outcrop of The Dalles Formation, Miocene Epoch. See Figure 1 and Figure 2 for the project location. See Appendix A for photographs of the landfill site.

Fractured basalt underlying and surrounding the site may be present. However, different conclusions have been reached by different parties. At the time the landfill was proposed in 1982, an engineering report concluded from six holes drilled to depths of approximately 23 feet that there was a solid rock basalt layer a minimum of 10 feet thick below the bottom of the proposed waste site and a minimum of 20 feet surrounding the perimeter, with no detectable fissures, flaws or fractures within the rock[2]. However, Ecology staff drilling logs for several wells drilled adjacent to the landfill in 2005 report fractured basalt at depths as shallow as 4 feet in one well, 7 feet in a second well, 14 feet in a third well, 32 feet in a fourth well, and 34 feet in a fifth well. Additionally, elevated levels of salts measured in groundwater appear to support the view that some pathways from the landfill to groundwater, such as fractures, do exist.

In June and July of 2005, the Washington Department of Ecology oversaw the installation of five groundwater monitoring wells onsite, adjacent to the landfill, to determine the depth to groundwater and the impacts the landfill may be having on the groundwater in the area. Results are summarized in the next section of this report, Section 2.3 Contaminants of Concern.

In April 2006, Ecology oversaw additional sampling of the aluminum waste in the landfill using a geoprobe. Geoprobe is a brand of hydraulically powered machines using the direct push technique to obtain soil samples. Direct push means pushing tools and samplers into the ground rather than having to drill to remove soil or make a path. Essentially the weight of the geoprobe machine is used as a hammer to drive the steel and sampler into the ground.

A key finding from one geoprobe boring was a zone at the bottom of the aluminum waste (27 to 29 feet below the surface of the landfill cover) with perched water, an elevated temperature, and a strong odor of ammonia gas being evolved. In addition, the geoprobe was not able to penetrate a dense layer approximately eight feet below the surface in the center of the landfill.

Ecology has conducted a Site Hazard Assessment pursuant to MTCA on the unlined landfill site. The site has been added to the state Hazardous Sites List and assigned a hazard ranking of 2, where 1 represents the highest relative risk and 5 represents the lowest relative risk. In other words, the RAMCO site is among the upper 40 percent of sites according to the risk it presents.

2.3 CONTAMINANTS OF CONCERN

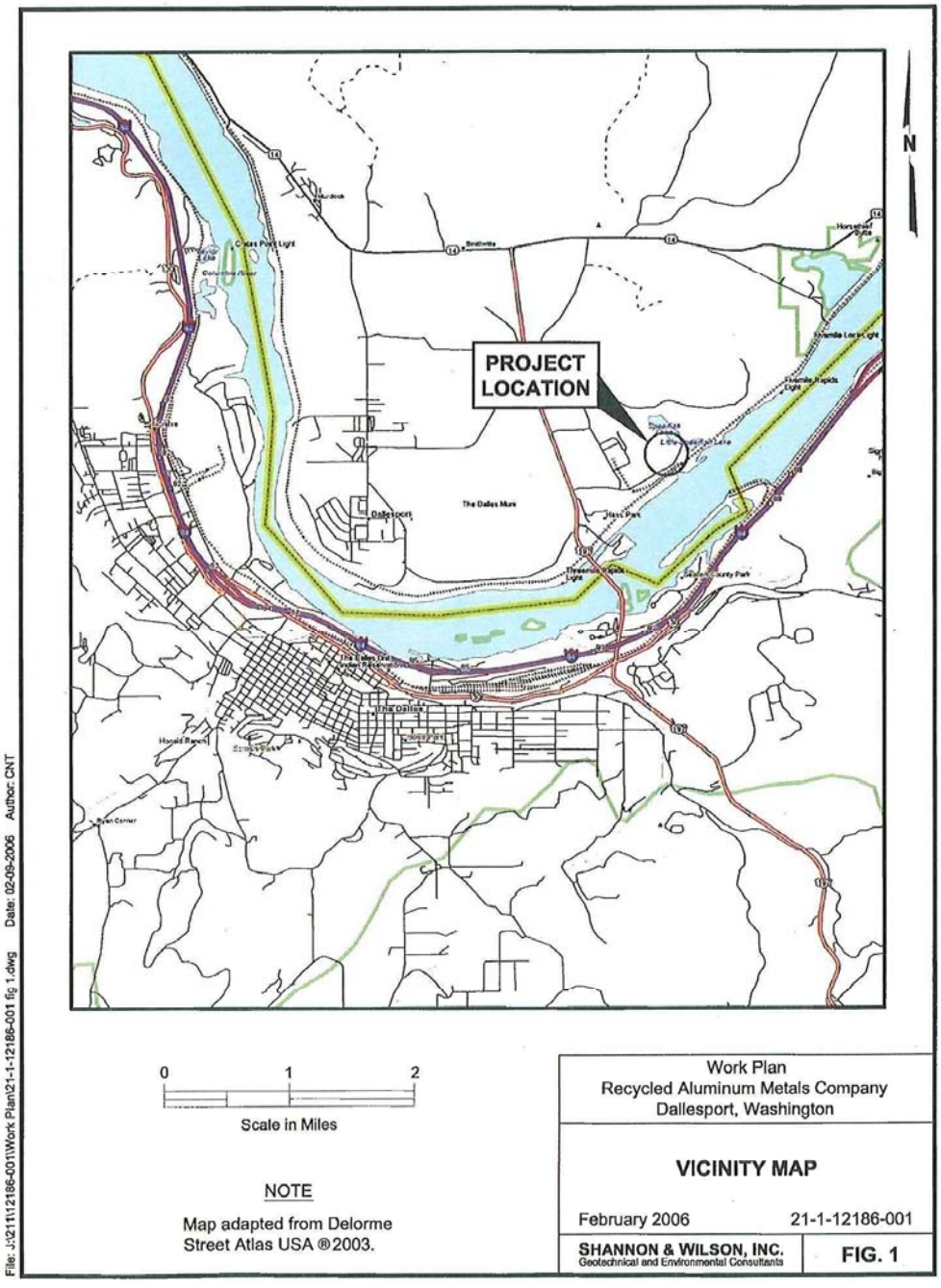
The waste in the landfill contains up to 28 percent aluminum, up to 8 percent sodium, up to 2.8 percent magnesium, up to 2.1 percent calcium, up to 1.5 percent potassium, plus lesser amounts of chromium, manganese, iron, copper, nickel and zinc.

[2]Engineering Report Supplement: R.A. Barnes Industrial Waste Site Application, Tenneson Engineering Corporation, April 16, 1982.

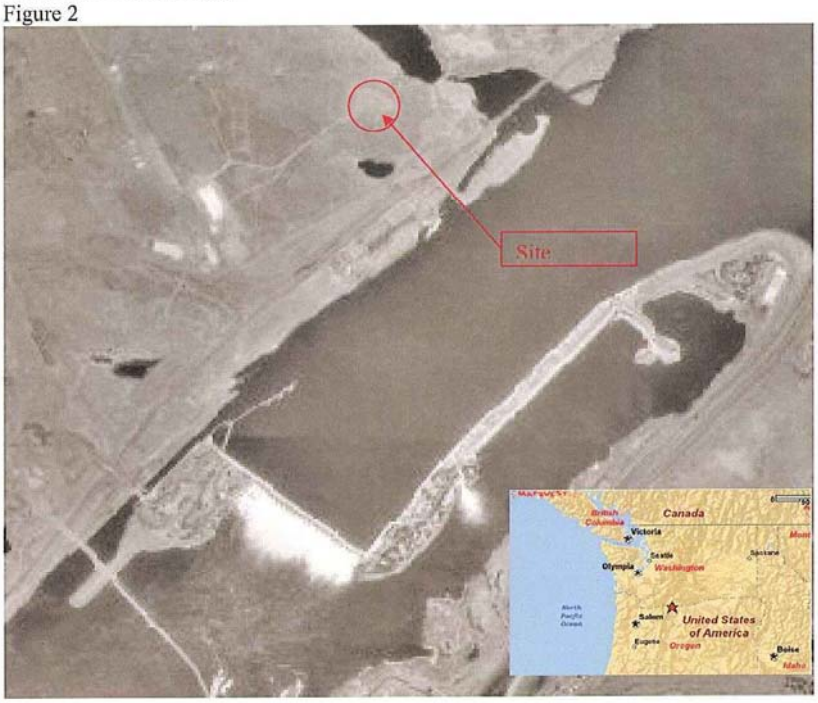
The waste material placed in the landfill produced ammonia gas when wet. The odor of ammonia has been detected in the past during both geoprobe sampling and groundwater monitoring.

Nitrates, sodium, chloride, and total dissolved solids in groundwater have been measured at levels exceeding primary or secondary water quality standards. Because major salt-forming chemical elements (sodium, calcium, potassium) measured during groundwater sampling exceeded levels of these elements found in seawater, there is a strong indication that salts from the landfill are leaching into groundwater.

Leaching tests performed to determine whether the waste is a Dangerous Waste indicate that metals also could leach from the aluminum waste. However, groundwater monitoring thus far has not shown elevated levels of metals attributable to leaching from the landfill.


PROJECT LOCATION
N
0
1
2
Scale in Miles
NOTE
Map adapted from Delorme Street Atlas USA ®2003.
Work Plan
Recycled Aluminum Metals Company
Dallesport, Washington
VICINITY MAP
February 2006
21-1-12186-001
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants
FIG. 1
File: J:\21\1\12186-001\Work Plan\21-1-12186-001 fig 1.dwg Date: 02-09-2006 Author: CNT

PROJECT LOCATION
Figure 2



Recycled Aluminum Metals Company Site, 45.6256N 121.1309W.

3.0 DESIGN CONSIDERATIONS

3.1 STATE CLEANUP REGULATION

According to the state cleanup regulation[3], an "interim action" is distinguished from a "cleanup action" in that an interim action only partially addresses the cleanup of a site. (The remediation conducted under an interim action may end up constituting the complete cleanup action for a site, however, if the interim action subsequently is shown to meet requirements in the rule for a complete cleanup action.) The state regulation defines three categories of interim actions.

The interim action proposed for the RAMCO site qualifies under the following one of the three categories defined in the state rule. WAC 173-340-430 (a) defines an interim action as "A remedial action that is technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance at a facility." The RAMCO interim action will reduce a threat to the environment by substantially reducing the pathway of leaching from the salt cake through fractured basalt to the groundwater and from the groundwater to surface water, including the Columbia River.

WAC 173-340-430 (2) states that interim actions may:

(a) Achieve cleanup standards for a portion of the site

(b) Provide a partial cleanup, that is, clean up hazardous substances from all or part of the site, but not achieve cleanup standards; or

(c) Provide a partial cleanup of hazardous substances and not achieve cleanup standards, but provide information on how to achieve cleanup standards for a cleanup; for example, an unproven cleanup technology demonstration project.

Additional requirements of an interim action, as stated in WAC 173-340-430, are that the interim action will be consistent with the cleanup action and that the interim action shall not foreclose reasonable alternatives for the cleanup action. (The rule provides the following qualifier to the latter requirement: "This is not meant to preclude the destruction or removal of hazardous substances.") A Cleanup Action Plan has not yet been written for the RAMCO site, but source removal is widely accepted as an appropriate cleanup technique, particularly in cases where an on-going threat to groundwater exists. The removal of the aluminum waste does foreclose the option of capping this same aluminum waste in place, but the qualifier quoted above clearly allows such a removal.

3.2 SIMILAR SITES

Washington has been a leading state in primary aluminum production for about sixty years. In the late 1990s, Washington had seven primary aluminum smelters while no other state had more

[3]WAC 173-340-430(1)

than two. States with two primary aluminum smelters at that time included Kentucky, New York, and Oregon. States with one primary aluminum smelter included Indiana, Maryland, Missouri, Montana, North Carolina, Ohio, South Carolina, Tennessee, Texas, and West Virginia[4].

A search was conducted for sites similar to the RAMCO disposal site. The following is likely not a complete listing of sites where predominately aluminum waste was land-disposed, or landfills which accepted this type of waste as a small percentage of their waste stream. However, the two site histories below each illustrate at least one factor worthy of consideration in devising an interim remedial action.

Brantley Landfill (Island, Kentucky)

Located on the west side of Island in McLean County, Kentucky, the Brantley Landfill closed in 1980, covering four acres and containing 250,000 tons of salt cake fines, a by-product of the secondary recovery of aluminum originating from Barmet Aluminum Corporation's smelter in Livia, Kentucky. A layer of soil was placed over the landfill area and the site was fenced.

Approximately 200 persons live within ¼ mile of the landfill. State air pollution control regulators received numerous complaints of ammonia odor from residents and cited the landfill for odor and dust emissions. In 1986, EPA confirmed ammonia emissions from the site. The salt cake fines contain various heavy metals and react with water to form several gases, including ammonia, acetylene, methane, hydrogen, and hydrogen sulfide.

The waste was deposited below the water table. There are six private wells within a one-mile radius; the closest is approximately 500 feet from the landfill.

The site was placed on the National Priorities List pursuant to CERCLA, commonly known as the Superfund law, in the late 1980s. In 1993, Barmet Aluminum performed repairs to prevent further erosion and exposure of waste material. In 1995, EPA issued an order to Barmet Aluminum for Remedial Action and the company installed 14 additional monitoring wells and six piezometers. In 1997, the company conducted the following remedial activities: installation of a landfill cap, construction of three ditches, and installation of erosion control matting. Following the Remedial Action, the company has conducted on-going air quality monitoring to confirm that ammonia emissions have been mitigated by the landfill cap.

Heglar Kronquist (Spokane, Washington)

Between 1969 and 1974, this nearly four-acre former gravel pit near the intersection of Heglar and Kronquist Roads in a rural area approximately 10 miles northeast of Spokane was used for

[4]Mineral Industry Surveys: Primary Aluminum Plants Worldwide – 1998 Part II – Summary, U.S. Department of Interior U.S. Geological Survey, July 1999.

disposal of up to 55,000 cubic yards of aluminum dross waste from a Kaiser Aluminum plant in Spokane.

In 1971, Ecology noted an ammonia-like odor emanating from the dross pile. In 1974 chloride salts were detected in high concentrations in adjacent downgradient shallow water supplies (wells and springs). Between 1973 and 1980, the Spokane County Health Department sampled groundwater and springs on nine occasions. They concluded the disposed dross was a source of high levels of chloride and sodium and recommended an alternative source for drinking water.

In 1979, an Ecology inspection noted sink holes and pressure mounds four to five feet in diameter. In the same year, air sampling measured ammonia. Ecology analysis of groundwater sampling concluded that slightly elevated levels of arsenic, cadmium, lead, mercury, and nitrate were not attributable to the landfill and that fluoride and iron, while present in the waste pile, were not migrating significantly.

In 1984 and 1985, Kaiser constructed a two-foot clay layer over the landfill to prevent infiltration of precipitation and performed grading to divert surface water run-on from penetrating the landfill. In 1987, an Ecology inspection noted the surface had been capped and was covered with weeds and grasses, with no evidence of sink holes or heaving. There were 17 10-foot high gas vents spaced throughout the site and the perimeter was secured by a fence and locked gate.

In November 1993, a Site Inspection Prioritization Level I report prepared for the U.S. Environmental Protection Agency recommended no further action under the federal Superfund program at that time. It was noted that additional groundwater and spring water samples were to be collected by Kaiser.

In 2006, Ecology notified Kaiser that a site hazard assessment of the Heglar Kronquist site will be conducted pursuant to the Model Toxics Control Act by Ecology.

3.3 IS THE ALUMINUM WASTE A HAZARDOUS WASTE?

Waste designated as Hazardous Waste (the federal term under RCRA) or Dangerous Waste (the term under Washington State regulations similar to RCRA but slightly different) cannot be taken to solid waste landfills, such as the Roosevelt Regional Landfill, but must be taken to facilities specifically permitted to receive Hazardous Waste.

There are multiple ways, which often involve performing certain tests on the material, to designate as Hazardous or Dangerous Waste. The most recent and therefore most representative analyses, conducted in 2006, showed that the aluminum waste in the RAMCO disposal site did not fail the Acute Fish Toxicity Test. Testing of the waste in the 1990s and in 2006 also demonstrated that it did not fail the Toxicity Characteristic Leaching Procedure (TCLP). A third way that this waste potentially could qualify as a Dangerous Waste is reactivity, but consideration of this issue in the 1990s did not result in the waste being designated a Dangerous

Waste. While there are other ways that a waste can qualify as a Dangerous Waste, this essentially means this waste is not a Dangerous Waste or a Hazardous Waste under the rules and policies currently in effect.

This is important for two reasons. One, it provides for additional disposal options. Two, Ecology has concluded at least one occasion in the past (1991) some of the waste produced by RAMCO was a Dangerous Waste, according to the rules and policies in effect at that time.

While the 2006 analyses are the most recent and representative available, there is some question about the homogeneity of the waste. The fact that one geoprobe boring in 2006 encountered a perched groundwater zone where heat and ammonia were being generated constitutes evidence of reactivity for at least that small portion of the waste. This zone of perched groundwater was not sampled and analyzed by leach procedure or fish toxicity testing, but a sample taken just above this zone in the same boring did not fail the Acute Fish Toxicity Test.

3.4 WASTE CHARACTERISTICS AFFECTING TRANSPORTATION AND DISPOSAL

Aluminum dross is a flammable solid and contact with water may cause self-heating and evolution of flammable gas. One Material Safety Data Sheet states it this way: "Avoid contact of dross with water. It is possible for water to react with dross to form acetylene, ammonia, hydrogen, and methane."[5]

Salt cake produced from secondary recovery of aluminum from dross also appears to exhibit some of these characteristics. On one occasion, salt cake from Bens Run Recycling in West Virginia being transported in Ohio is reported to have spontaneously ignited.[6]

Self-heating to the point of causing a fire would make a waste unacceptable for disposal in a landfill. A plan must include measures to prevent such material from being sent to a landfill.

The generation of ammonia also could present a problem within a landfill. However, Ecology concluded in the 1990s Roosevelt Regional Landfill's gas and leachate collection systems and liner could adequately deal with disposal of the open stockpile of salt cake from RAMCO.

3.5 INTERIM ACTION ALTERNATIVES

The following cleanup action alternatives were considered for the RAMCO Site:

- No action – This option was not selected based on evidence that the situation has not been stabilized or contained. The evidence includes groundwater monitoring

[5]Material Safety Data Sheet # 126 Aluminum Dross, Reynolds Metals Company, 9/24/84
[6]Thomas Cusack, Department of Ecology, memorandum summarizing telephone conversations in July and August, 1992, with State of Ohio and EPA regulators.

showing migration from the landfill to the groundwater and a soil boring indicating that an exothermic, ammonia-generating process exists within the landfill in 2006.

- Institutional controls, such as fencing, signage, and restrictive covenant limiting use of the land – This option was not selected as the sole option, based on evidence that the situation has not been stabilized or contained.
- Covering the aluminum waste with a more impermeable cap plus institutional controls – This option was not selected based on evidence that the situation has not been stabilized or contained.
- Removal of the aluminum waste – Physical removal by excavation was the option selected.

The alternative chosen will permanently stop leaching from the unlined disposal site. It will not address contamination that already has reached groundwater.

4.0 INTERIM CLEANUP ACTION PLAN

A qualified and experienced contractor will perform the following work: Excavation of approximately 63,200 cubic yards (in place) of aluminum waste and soil and disposal of this material at a RCRA Subtitle D landfill.

The excavation will be accomplished by front-end loader, hydraulic excavator, bulldozer, or similar mobile equipment.

Transportation to the landfill most likely will be entirely by truck, although transportation by rail to the landfill will be considered if it is economically favorable compared to trucking alone.

Material that meets the following criteria can be loaded directly into trucks for transport to the RCRA Subtitle D landfill chosen for disposal:

- Upon excavation, does not emit a detectable odor
- Upon excavation, does not emit a visible smoke or water vapor plume
- Does not exceed a temperature of 130 degrees Fahrenheit
- Passes through a 1.5-inch screen

Other excavated material will be set aside and will be treated by crushing and aeration prior to transportation to the landfill.

4.1 EXCAVATION LIMITS

The aluminum waste is light grey or white in color. The underlying basalt is brown or dark grey in color. The soil that was placed over and around the aluminum waste is brown. A visual criterion will be used to determine the limits of excavation. All light grey or white material will be excavated. All loose soil covering light grey or white material, commingled with light grey or white material, or forming the dike or blankets surrounding light grey or white material also will

be excavated. This will restore the basalt bowl to its approximate condition immediately prior to the start of waste disposal in the early 1980s.

4.2 SAFETY AND HEALTH

The site will be restricted from public access throughout the construction period by a 6-foot high chain link fence. (Note: The site currently is not fenced. A locked gate prevents vehicles from using the access road to drive up on the landfill cover, but vehicles could drive around the gate. People hike this general area, often with their dogs. On one occasion Ecology staff observed a hiker who walked up on the landfill cover.) The contractor will be required to provide a specific Safety & Health Plan for the site construction activities. The plan will include, but not be limited to, air monitoring for ammonia gas with appropriate action levels at which workers will be required to wear Air-Purifying Respirators and air-supplied respirators or SCBA.

4.3 EROSION CONTROL PLAN

As mentioned above, once the interim remedial action is complete, the contour of the ground will be returned to what existed immediately prior to the start of waste disposal in approximately 1982. The key to limiting erosion during the period immediately following the excavation is to completely excavate material containing fines down to the basalt.

Regarding the important subject of erosion control during construction itself, the centerpiece of the plan is diligent surveillance. In addition, Ecology will commit to escalate to a more rigorous Best Management Practice (BMP) with any indication that measures in place might not prove adequate. Excavation will proceed from west to east so that the dike preventing surface water drainage toward Spearfish Lake remains in place until near the end of the job. Vehicle trackout will be cleaned up in a timely manner. Measures will escalate to Silt Fence (BMP C223 in the Stormwater Management Manual for Eastern Washington), Wheel Wash (BMP C106), and Sediment Trap (BMP C240) as needed. In the unlikely event that these prove inadequate, our engineer will choose a remedy based on site-specific conditions at the time.

4.4 DUST CONTROL PLAN

The contactor will be required to control dust and to prepare a dust control plan. Dust control measures, at a minimum, will include a water truck and sprinklers.

Water was used for dust control when waste was being placed in the landfill in the 1980s. On at least one occasion insufficient water was applied, resulting in a complaint that windblown dust was impacting the neighboring Spearfish Lake boat launch operated by the US Army Corps of Engineers.

4.5 PUBLIC PARTICIPATION PLAN

A Fact Sheet describing the proposed Interim Remedial Action will be mailed to addresses identified by Ecology as being within the potentially affected vicinity. The Fact Sheet will describe a comment period for the Interim Remedial Action Plan and State Environmental Policy Act (SEPA) threshold determination.

Two groups within the community merit special consideration in the crafting of a public participation plan. The first group is Native Americans. The general area was long used for fishing by local tribes and as a meeting place by Native American tribes from various parts of the Northwest and beyond. The Yakama Nation will be one of the entities notified in the SEPA process. In an attempt to increase the likelihood that word of this project reaches Native Americans who live or work along the river, that notification will be augmented by posting copies of the Fact Sheet at boat ramps in the area used by Native American fishers. The notification also will be expanded outside of Washington State to include the Warm Springs, Umatilla, and Nez Perce tribes. These three tribes received monetary compensation for the loss of fishing sites flooded by construction of The Dalles Dam (along with the Yakamas, who received the largest amount of monetary compensation.) Other tribes downstream and upstream of the site may be added to the mailing list for the Fact Sheet.

The second group is residents of Oregon. The north bank of the Columbia River is approximately 1000 feet from the landfill site. The boundary between the states of Washington and Oregon runs within the old channel of the Columbia River. Some Oregon residents have commented on other projects conducted pursuant to Washington State laws that they didn't feel included in the process. Notice of the comment period will be published one time in the The Dalles Chronicle, a newspaper published six days a week in The Dalles, Oregon.

5.0 ABBREVIATIONS AND ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act – a federal law, often called the "Superfund law," regarding cleanup of contaminated sites.
CFR	Code of Federal Regulations – federal regulations
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
MTCA	Model Toxics Control Act – a Washington state law regarding cleanup of contaminated sites.
RCRA	Resource Conservation and Recovery Act – a federal law
SCBA	Self-Contained Breathing Apparatus
WAC	Washington Administrative Code – Washington state regulation

APPENDIX A

Photo # 1 – West edge of the landfill occupies the center left and lower left of photo. Basalt outcrop bluff in upper left and center forms the south wall of the bowl in which the unlined landfill sits. Columbia River, also known as Lake Celilo at this point, is in the background to the south. Orange pipes in center indicate position of monitoring well. (Photo by Jeff Newschwander)

Photo # 2 – Looking northwest and down on landfill cover from atop basalt outcrop bluff that forms southern wall of bowl in which the landfill sits. The landfill cover is the relatively flat area that occupies most of the photograph. The vehicles are parked on the landfill cover. Note Bonneville Power Administration electrical power transmission lines and tower. (Photo by Jeff Newschwander)

Photo # 3 – Looking north, with the east edge of the landfill on the left. Spearfish Lake is outside of the photo frame on the right. Orange pipes indicate locations of groundwater monitoring wells. (Photo by Jeff Newschwander)

Photo # 4 – Geoprobe machine and operator indicate scale of basalt outcrop bluff which forms south wall of bowl in which the landfill sits. (Photo by Jeff Newschwander)